Phosphorus Fractions under Planted *Pueraria phaseoloides* Crop-fallow System: A Comparison with Natural Regrowth

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Abstract

The potential of planted leguminous cover crop fallow in comparison to the natural regrowth fallow for sustaining P availability of low activity clay (LAC) soils in the tropics as the fallow period shortens was assessed at the International Institute of Tropical Agriculture, Ibadan, in the forest–savanna transition zone of southwestern Nigeria. Phosphorus availability and crop yields under the cover crop–fallow and a traditional system (natural fallow–NF) were compared in 1998 and 1999 in a long-term fallow management trial initiated in 1989. *Pueraria phaseoloides* was sown with a maize–cassava intercrop at the same season. In a 2-year cycle, 1 year of cropping was followed by 1-year fallow with *Pueraria* for the cover crop–fallow system or with natural regrowth (mainly *Chromolaena odorata*) for the natural fallow system. Maize–cassava intercropping without a fallow period (continuous cropping) was included as a control. No fertilizer was applied throughout the experimental period. *Pueraria* produced $3.9 \text{ t ha}^{-1}$ dry matter (DM) in 1998 and $8.3 \text{ t ha}^{-1}$ DM in 1999 after the fallow period. DM production from NF was $5.7 \text{ t ha}^{-1}$ in 1998 and $7.8 \text{ t ha}^{-1}$ in 1999. Phosphorus accumulation in *Pueraria* biomass was $4.3 \text{ kg ha}^{-1}$ in 1998 and $6.1 \text{ kg ha}^{-1}$ in 1999. Phosphorus accumulation in NF biomass was similar to that of *Pueraria* in 1998 but was significantly higher ($8.9 \text{ kg ha}^{-1}$) than in *Pueraria* in 1999. In 1998, NF had significantly higher Olsen extractable P than *Pueraria* fallow. Biologically plant available P fractions (resin P, NaHCO₃, inorganic P (P), and easily mineralizable P fraction NaHCO₃, organic P (P) were higher under NF than under *Pueraria* fallow and continuous cropping. Although P availability was higher under NF than under *Pueraria* but crop yields under crop–fallow with *Pueraria* were comparable with those under NF. Continuous cropping without the use of chemical fertilizer produced over 200% less maize grain and about 40% lower cassava tuber yields compared with the crop–fallow systems.

Introduction

Throughout the tropics, the shifting cultivation method has been widely used by small-scale farmers as a means of maintaining soil fertility. The method involves manual clearing, burning, and cropping a relatively small area of land for one or two years followed by a long period of natural fallow (10–30 years). The land is usually allowed to return to forest vegetation through a series of plant species successions to restore soil fertility (Nye and Greenland, 1960; Sanchez, 1976; Mokwunye...